

Claims:

I claim:

1. A device for delivery of a liquid medicament to an animal comprising:
a reservoir for containing the liquid medicament;
a needle for penetrating the skin of the animal;
a flow tube in fluid communication with the needle and the reservoir;
means for causing the liquid medicament to flow from the reservoir to the animal;
a memory device for storing a schedule of delivery of the liquid medicament to an animal in terms of dose or dosing rate or both dose and dosing rate as a function of time;
a meter for measuring the time required for an increment of liquid medicament to flow a prescribed distance along the flow tube; and
a valve for starting and stopping liquid flow in the flow tube in a periodic manner;
wherein the time the valve is open or closed each period is adjusted to compensate for changes in system parameters as determined by measurements made by the meter so that the schedule of delivery is followed.
2. The device of claim 1 comprising two matable components; a first disposable component comprising the medicament containing reservoir, the needle, and the flow tube, and a second reusable component comprising the valve, the meter and the memory device.
3. The device of claim 1 wherein the liquid medicament is an insulin formulation.

4. The device of claim 1 wherein the liquid medicament is an analgesic or anesthetic formulation.
5. The device of claim 1 wherein the device compensates for a change in liquid medicament driving force by making an adjustment of the time that the valve is open or closed.
6. The device of claim 1 wherein the device compensates for a change in the viscosity of the liquid medicament by making an adjustment of the time that the valve is open or closed.
7. The device of claim 1 wherein the device compensates for a change of flow tube lumen dimensions by making an adjustment of the time that the valve is open or closed.
8. The device of claim 2 wherein the device compensates for a change in flow tube lumen dimensions by making an adjustment of the time that the valve is open or closed when the reusable component is first mated to a fresh disposable component.
9. The device of claim 1 wherein the meter comprises a first laser adapted to heat a volume of medicament in the flow tube, a second laser adapted to illuminate the flowing medicament a prescribed distance downstream from the first laser, a detector adapted to detect a change in the illumination from the second laser caused by the passing of the heated volume of medicament, and a timer adapted to measure the time the volume of medicament takes to flow from the position where it is heated to the position where it is detected.

10. The device of claim 9 wherein the first laser is an infrared laser.
11. The device of claim 10 wherein the infrared laser has a wavelength within an absorption band of water.
12. The device of claim 9 wherein the heated volume of medicament is detected by a change in the illumination from the second laser caused by a change of index of refraction of the heated volume of medicament.
13. The device of claim 9 wherein the meter further comprises a grating adapted to the first laser to heat two volumes of medicament simultaneously a fixed distance apart.
14. The device of claim 13 wherein the measured time is the time required for the two heated increments of medicament to flow by the position of the second laser.
15. The device of claim 9 wherein the meter further comprises a grating adapted to the second laser to illuminate two positions of the flow tube and a detector to detect a change in the illumination passing through each of the two illuminated positions of the flow tube.
16. The device of claim 15 wherein the measured time is the time required for the heated increment of liquid medicament to flow between the two positions illuminated by the second laser.

17. The device of claim 2 wherein the disposable component includes a surface with an adhesive for adhering the disposable component to the skin of an animal.

18. A method of delivering a liquid medicament to an animal including the steps of

a) providing a two component drug delivery device wherein the first component comprises a reservoir for containing a liquid medicament, a needle for penetrating the skin of the animal, a flow tube connecting the reservoir and the needle, and a means for causing the medicament to flow from the reservoir to the animal, and wherein the second component is matable with the first component and comprises a valve for starting and stopping flow in the tube, a memory device for storing a delivery schedule for the liquid medicament in terms of dose or dosing rate or both dose and dosing rate as a function of time, and a meter for measuring the time required for an increment of the liquid medicament to flow a prescribed distance along the flow tube,

b) using the meter to measure the time required for an increment of the liquid medicament to flow a prescribed distance along the flow tube, and

c) using the measured time to deliver the liquid medicament according to the schedule by adjusting the time that the valve is open or closed to compensate for changes in system parameters.